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MASTER OF MILITARY STUDIES

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**TITLE:**

GREEN CONSTRUCTION INITIATIVES IN OVERSEAS CONTINGENCY OPERATIONS

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## *Executive Summary*

**Title:** Green Construction Initiatives in Overseas Contingency Operations

**Author:** Major Joshua D. DeMotts, United States Air Force

**Thesis:** The politically driven Title 10 constraints placed on military engineers working in contingency operations significantly hinder the Air Force's ability to incorporate sustainable features and practices into minor construction projects. Furthermore, to combat this problem, an increase to the minor construction funding threshold is required immediately and additional published guidance needs to be provided to engineers in the field.

**Discussion:** Air Force Engineers supporting contingency operations are forced to trade away sustainable facility features for square footage on a regular basis. The primary driver for this is the restrictions placed on the Services by Title 10 and the urgency in which these facilities are required. To support this argument, my paper research is presented in four primary categories. First, I will explore green building techniques and their importance to today's environment. My focus here will be to define Leadership in Energy and Environmental Design (LEED) principles from the U.S. Green Building Council database and explore their applicability to a contingency environment. Second, I will explain the three ways the U.S. Air Force accomplishes construction downrange. This will include line item appropriated Military Construction (MILCON) projects, specially appropriated wartime Contingency Construction Authority (CCA) and minor construction, or Operations and Maintenance (O&M) construction. Also in this section, I will explain applicable sections of the governing documents that outline restrictions on downrange construction, including Title 10 regulations and Air Force instructions. Third, I will offer some qualitative interview data addressing how corners are cut during construction to ensure engineers on the ground meet the ultimate intent of Title 10 and other regulations. Fourth, I will compare the intent of the laws and regulations with their actual application to downrange construction, demonstrating a disconnect between the intent of laws and regulations and their application in the field. Ultimately, my argument demonstrates the importance of understanding the negative impacts Title 10 and subordinate DoD and Air Force instructions have on downrange installations with respect to incorporating sustainable features into new operations and maintenance construction projects.

**Conclusion:** Loosening of funding restrictions and clearly published green guidance on behalf of CENTCOM and the Air Force would enable contingency engineers to choose quality over quantity in minor construction projects. This will ease the stress on the logistical supply system and provide enhanced contingency facilities.

## *Preface*

This analysis was sparked by my personal experiences while seated as the commander of the 451st Expeditionary Civil Engineer Squadron at Kandahar Air Base, Afghanistan from February through July of 2010. Without hesitation, my time at Kandahar was both one of my most rewarding and frustrating experiences of my military career. It was rewarding because of the men and women I served with to complete the mission and frustrating because of the politically driven constraints placed on our construction initiatives. We were building a brand new expeditionary air wing (the Air Force's newest), supporting nine different air frames and over 1,500 Airmen less than \$750,000 at a time. The inefficiency was atrocious but there was little we could do about it because the mission had to come first yet we had to follow the law. During bar-side chats with friends and mentors I came to find out I was not the only one to experience such frustrations; thus this paper was born.

Many individuals deserve thanks and apologies for this paper. I'll start with the "I'm sorry" lines first. To my lovely (and very pregnant) wife Patti, sorry about the loss of all the weekends, I should have made better use of my PSPT but you know how distracted I get. To my little race car Salve, all those barks and growls did not go unnoticed; we'll play more ball in the backyard now, I promise. As for "thank you" lines, my mentor, Dr. Adam Cobb, deserves a big one. He vectored me in and let me run, just the way I like to work. To my Pentagon friends and bosses: Colonel Beth Brown, Lieutenant Colonel Rick "Steve" Dwyer, Tom "PDT" Lowry and Major Todd Graham; thanks for taking time out of your busy schedules to chat. To my Kandahar team that made Camp Losano a reality, you guys are awesome...now get back to work! Finally, and mostly, a huge thanks to my own private on-call PhD, my big sister Dr. Rachel DeMotts. Without you, this paper would have crashed months ago. You got me going, kept me on track and made my sound smarter than I am which is a feat of its own; I owe you a G&T or two.

Green Construction Initiatives in Overseas Contingency Operations

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18 March 2011

On 4 July 2010, the commander of the 451st Air Expeditionary Wing at Kandahar Air Base in Afghanistan, Brigadier General Guy M. Walsh, presided over the ribbon cutting ceremony for the Wing's newest compound, Camp Losano (see Appendix A). Camp Losano consisted of three approximately 6,000 square foot office facilities, lodging for 550 Airmen, twin 1.1 Megawatt diesel generator power production plants, and supporting water and wastewater infrastructure. During his speech, General Walsh touted the project's success, stating "this was all done by Airmen for Airmen, and it's a proud day for the 451st."<sup>1</sup> Even the name of the camp signified the proud heritage of the 451st. Airman First Class Raymond Losano, a tactical air command and control specialist, was posthumously awarded a Bronze Star with valor and a Purple Heart after being mortally wounded in a firefight in eastern Afghanistan in 2003.<sup>2</sup> During his entombment at Arlington National Cemetery, Airman Losano was referred to as a hero as General John P. Jumper, then Chief of Staff of the Air Force, personally presented flags to Losano Family members.<sup>3</sup>

The theme was common; Airman First Class Raymond Losano's actions exemplified the Air Force core value of "Excellence in all we do." But does the camp bearing his name truly represent this kind of excellence? Facilities lack central heating and cooling systems, sewage dumps into holding tanks requiring twice daily pumping and trucking, and inefficient electrical generators drink approximately 80 gallons of fuel per hour to produce approximately 1.1 Megawatts of power no matter the draw. In short, green (or sustainable) construction techniques were traded for square footage. Sustainable features were considered but the \$750,000 minor construction limit proved too restrictive and mission requirements took precedence over sustainability.<sup>4</sup> In this way, Camp Losano is clearly representative of downrange construction projects. Congressionally-imposed regulations force engineers into choices between green

features and usable space almost daily in contingency environments. Therefore, I argue that politically driven Title 10 constraints placed on military engineers working in contingency operations significantly hinder the Air Force's ability to incorporate sustainable features and practices into minor construction projects. Furthermore, to combat this problem, an increase to the minor construction funding threshold is required immediately and additional published guidance needs to be provided to engineers in the field.

To support these arguments, my paper is constructed in four sections. First, I will explore green building techniques and their importance to today's environment. My focus here will be to define Leadership in Energy and Environmental Design (LEED) principles from the U.S. Green Building Council database and explore their applicability to a contingency environment. Second, I will explain the three ways the U.S. Air Force accomplishes construction downrange. This will include line item appropriated Military Construction (MILCON) projects, specially appropriated wartime Contingency Construction Authority (CCA) and minor construction, or Operations and Maintenance (O&M) construction. Also in this section, I will explain applicable sections of the governing documents that outline restrictions on downrange construction, including Title 10 regulations and Air Force instructions. Third, I will offer some qualitative interview data addressing how corners are cut during construction to ensure engineers on the ground meet the ultimate intent of Title 10 and other regulations. Fourth, I will compare the intent of the laws and regulations with their actual application to downrange construction, demonstrating a disconnect between the intent of laws and regulations and their application in the field. Ultimately, my argument demonstrates the importance of understanding the negative impacts Title 10 and subordinate DoD and Air Force instructions have on downrange installations with

respect to incorporating sustainable features into new operations and maintenance construction projects.

### **What is LEED and “Green” Construction?**

The concept of building “green” facilities “encompasses ways of designing, constructing and maintaining buildings to decrease energy and water usage and costs, improve the efficiency and longevity of building systems, and decrease the burdens that buildings impose on the environment and public health.”<sup>5</sup> Green (or sustainable) construction takes on many forms, from a simple motion detecting switch that automatically turns the power off when no occupants are present to an entire integrated “living” roof that filters air, reduces heating and cooling requirements and fosters wildlife. Green features aim to take advantage of passive strategies while optimizing the integration of internal and external building systems.<sup>6</sup> Possibly the most important function of a green facility is customized features that blend into the local climate and environment. In short, no one size-fits-all solution exists. From Alaska to Iraq, the shape that green features take on can be very different; yet no matter the technique, the focus is constructing facilities that are more sustainable.

The U.S. Green Building Council has come to the forefront of the sustainable construction industry. To facilitate green construction they have developed and enhanced the LEED certification system over the past decade. The focus of LEED is to provide building owners and operators a basis for identifying and implementing practical, measurable and affordable green building designs; construction practices and materials; and enhanced operations and maintenance solutions.<sup>7</sup> The Green Building Council defines the overall program on their website in the following manner:

*LEED is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, CO<sub>2</sub> emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.*<sup>8</sup>

LEED and sustainable features are flexible enough to apply to all building types in every type of surrounding environment.<sup>9</sup> Consequently, incorporating LEED principles into construction in contingency environments should be a focus of expeditionary engineers.

Incorporating LEED principles makes facilities more energy efficient, easier to maintain and more user friendly. Benefits of energy efficiency are two-fold: first, energy efficient facilities reduce the demand on fuel consumption, which reduces the burden on contingency logistics; and second, green facilities benefit the environment through lowering carbon dioxide emissions, decreasing fossil fuel burning and reducing quantities of industrial waste.<sup>10</sup> Lower maintenance requirements on green systems benefit deployed forces again through reduced logistical requirements and also on reduced labor to maintain the systems. Finally, user friendly features aid in simplifying day to day operations in the deployed environment. For example, central heating, ventilation and air conditioning (HVAC) systems keep work environment temperatures consistent and more comfortable. Besides just simply being the right thing to do, the U.S. Environmental Protection Agency adds that though buildings and developments provide countless benefits to society, if constructed irresponsibly they may also have significant environmental and health impacts.<sup>11</sup>

### **LEED Application in the Contingency Area of Responsibility (AOR)**

With LEED benefits clear, recommendations for application of green techniques in the contingency environment can be explored. Frontier Associates, a small consulting firm with more than 65 years of experience providing energy-efficiency related services, recently

established the Green Affordable Housing Coalition whose mission is to educate the public on committing to the incorporation of green building practices into the design, construction, operation, and maintenance of affordable facilities.<sup>12</sup> In their Fact Sheet, Top 15 Green Building Ideas, they offer several strategies applicable to down range construction, clearly demonstrating that green construction practices could be useful in contingency environments.<sup>13</sup>

The first recommendation is to work with the climate.<sup>14</sup> Current contingency operations are focused primarily in southwest Asia, where “The basic climate of the Middle East can be characterized in two words: hot and dry.”<sup>15</sup> These hot desert conditions “induce a strong seasonal wind pattern in the region.”<sup>16</sup> To take advantage of the consistent direct sun, passive solar could heat water and provide ambient lighting while solar panels generated electricity. Also, during certain times of the year wind power could be harnessed. The second recommendation is to focus on quality and durability versus size.<sup>17</sup> According to a recent study completed by the Office of the Undersecretary of the Air Force, Installations and Environment, too often “commanders choose to spend O&M dollars to get the greatest square footage, willingly or unwittingly accepting much higher O&M costs for the life of the facilities.”<sup>18</sup> A focus on cutting back is in order instead of the typical insatiable appetite for space that dominates the modern contingency Air Force base.

A third technique on the Top 15 list is the use of a quality central HVAC system.<sup>19</sup> Typical downrange minor construction facilities do not have centralized HVAC systems, preferring individual small condenser and supply units due to their low-cost and ease of installation. However, the maintenance requirements and electrical draw on these individual units is astounding. For example, Camp Losano was heated and cooled with hundreds of individual low cost “Chigo” units, each having its own air supplier and condenser. When any

one unit broke, a technician had to respond. Additionally, the electrical draw was calculated at some 500 percent higher than had central HVAC systems been installed.<sup>20</sup> Fourth is the installation of high efficiency compact fluorescent lights, motion sensors, daylight sensors and dimmers.<sup>21</sup> Though not readily available in most contingency environments and far more expensive than their less efficient predecessors, these measures drastically cut down on electricity consumption in large part by removing the human factor (I forgot to shut the lights off) from the equation. For example, a typical billeting room at Kandahar Air Base had four fluorescent bulbs drawing 40 watts each for a total of 160 watts. The typical Airman at Kandahar worked six days per week, 12 hours per day for a total of 72 hours per week. At an average of two people per room and a manpower strength of approximately 1600 people, if everyone left their lights on when they went to work, Kandahar would have wasted over 900 kilowatt-hours of electricity every week. Though this obviously represents the worst case scenario, it is apparent that simple initiatives like motion detectors can offer potentially significant energy savings.

The fifth and final easily applicable energy savings technique from the Top 15 list is the installation of water saving fixtures in bathrooms.<sup>22</sup> The expense of potable water downrange is astronomical. The flow of water at typical contingency bases looks like this: water must be purified locally, chlorinated, pumped into trucks for distribution, driven to the required location and finally pumped into a holding tank that services individual facilities. Thereafter, wastewater undergoes the reverse process of use, holding, trucking, pumping and treating. This is an incredibly inefficient process and anything that can be done to decrease water consumption greatly decreases the logistical burden.

As green processes are explored, it becomes easy to see that efficiencies are readily applicable to any environment and that no matter how large or small the technology or procedure, benefits clearly exist. In this light, the focus moves from not whether simple green initiatives could benefit contingency installations but to why these techniques are not more readily employed. To answer this question, an explanation of rules and regulations governing contingency construction is in order.

### **Governing Laws and Instructions for Air Force Construction**

The Air Force accomplishes new construction by three primary means in contingency environments. The first is Military Construction (MILCON). MILCON projects are line item approved, appropriated through congressional subcommittees, and funded through supplemental war budgets. The funding floor for individual MILCON projects begins at \$750,000 and has no ceiling. The second is Contingency Construction Authority (CCA). CCA is a lump sum appropriation in a supplemental war budget but unlike MILCON, the projects are not line item appropriated. The funding range for CCA projects is the same as MILCON. The third way to build is Operations and Maintenance projects (O&M). These relatively small projects are approved within the Air Force and executed outside of the direct Congressional oversight. O&M construction falls below the \$750,000 limit per individual project. This section will touch on each of these funding and execution avenues, exploring the benefits and limitations of each while describing the conditions that create the constraints placed on O&M construction in contingency operations.

Section 2801 of the United States Code's Title 10 defines military construction as, "any construction, development, conversion, or extension of any kind carried out with respect to a military installation, whether to satisfy temporary or permanent requirements, or any acquisition

of land or construction of a defense access road.”<sup>23</sup> Furthermore, it explains that these projects must produce a stand-alone complete and usable facility or improvement to an existing facility as defined by the documentation provided to Congress.<sup>24</sup> In contingency environments, MILCON is funded by supplemental appropriations submitted to Congress by the President. These supplemental war related appropriations date back to World War I and are the primary means for the United States to pay for any “out of the ordinary” events.<sup>25</sup> The primary advocate for MILCON in contingency environments is the Combatant Commander. In the case of Southwest Asia, this is United States Central Command. In Fiscal Year 2010, the Air Force, with approval from USCENTCOM and the Secretary of Defense, submitted 24 MILCON projects for a total of \$513M.<sup>26</sup> Though these projects vary greatly in nature, it is safe to say that the bulk of Air Force MILCON projects in support of contingency operations are directly related to airfield operations (runways, taxiways, aircraft parking aprons and maintenance hangers). Additionally, MILCON projects in the AOR encompass approximately two years of planning and programming followed by a minimum of eighteen months of design and construction. Consequently, what this process makes clear is that MILCON projects are not going to be executed quickly, largely due to the direct role that a politicized Congressional process plays in them.

Section 2804 of the United States Code’s Title 10 defines Contingency Construction as occurring under the following conditions: “Within the amount appropriated for such purpose, the Secretary of Defense may carry out a military construction project not otherwise authorized by law, or may authorize the Secretary of a military department to carry out such a project, if the Secretary of Defense determines that deferral of the project for inclusion in the next Military Construction Authorization Act would be inconsistent with national security or national interest.”

<sup>27</sup> Though the exact sections governing CCA have changed over the years, <sup>28</sup> the definition provided above remains constant. The primary advocate for contingency construction is again the Combatant Commander. As previously stated, CCA projects are of MILCON funding scope but they are not line item appropriated, which yields reduced Congressional oversight in comparison to MILCON projects. The first year CCA funds were available for COCOM priorities was 2004. For the first 2 years, Congress appropriated \$200M annually. In 2006 the total went down to \$100M <sup>29</sup> and in 2008 it was increased to \$500M where it stayed until 2011, when it fell back to \$300M. The important role CCA plays for contingency operations is that it reduces the amount of time required to execute large-scale MILCON scope projects. MILCON projects can take upwards of three and a half years, but CCA projects can be executed in as little as half this time, reflecting their flexibility in meeting emerging mission requirements. This is primarily attributed to two factors: first, as the projects are not line item appropriated, Congress offers less oversight and project approval moves faster; and second, the funds allocated must be executed in the same year as appropriation. What this means is CCA projects must be large, uncomplicated projects which can be built quickly.

Air Force MILCON and CCA projects are regulated by Air Force Instruction (AFI) 32-1021, Planning and Programming Military Construction; AFI 32-1023, Design and Construction Standards; and AFI 32-1089, Air Force Military Construction. AFI 32-1021 provides guidance and direction on how to plan, develop, program and obtain proper approval for MILCON-scoped projects. This instruction applies to all Air Force installations regardless of service status and includes all types of construction except housing, medical, defense logistics, non-appropriated funds, host nation and O&M projects. <sup>30</sup> The following passage outlines the focus of this document:

The objective of facility project planning and programming is to provide quality facilities needed to perform the Air Force mission. All commanders and civilian directors shall support this objective by ensuring project requests meet validated requirements; are in compliance with all applicable standards; are programmed at the lowest life cycle cost; achieve optimum resource efficiency and minimize damage to the natural and human environments; and are within authorities and available resources.<sup>31</sup>

AFI 32-1023 provides design criteria and guidance, structure for selecting architect-engineering (A-E) firms, and information on design and construction management. The applicability criteria are the same as AFI 32-1021 with the addition of military family housing and O&M projects.

The guiding focus of the document is to first define the parties responsible for each step of the MILCON process; then, define design requirements; and finally, outline proper construction management practices.<sup>32</sup> The last document, AFI 32-1089, focuses strictly on the financial aspects of MILCON and applies to the same host of projects covered by 32-1023. Specifically, 32-1089 focuses on the proper execution of Economic Analyses (EAs) that are required as part of individual project justification for MILCON scope construction.<sup>33</sup>

Section 2805 of the United States Code's Title 10 defines Unspecified Minor Construction, or O&M Construction, as non-life, health or safety threatening projects not exceeding \$750,000 that may be approved by the relevant Service Secretary through the use of existing operations and maintenance appropriations.<sup>34</sup> The advocate for O&M construction is the individual service secretary delegated down the chain to the appropriate authority. Current Air Force Central Command (AFCENT) policy delegates O&M authority under \$300K to the individual wings. Projects over \$300K are sent to the AFCENT Civil Engineer for approval.<sup>35</sup> These approval authorities are the key to O&M construction, as the Air Force is allowed to build whatever is desired downrange without approval or oversight from the Combatant Commander – as long as it follows the basic rules defined in Title 10 and applicable AFI's. Internal to the Air Force, O&M construction is directed by AFI 32-1032. This instruction seeks to provide

guidance for the use of O&M funds for projects in the categories of maintenance, repair, and unspecified minor construction. As little Congressional oversight monitors the use of O&M funds, this document dives deep into the dos and don'ts of O&M funds with respect to construction initiatives.

On typical stateside installations, new O&M construction projects are virtually nonexistent. O&M funds are typically used for small scale renovations or repair projects. This is directly related to the extremely limited funding levels stateside installations receive in O&M funds. Basically, for a stateside installation to construct a new facility using O&M funds the construction project would have to compete against things like flying-hour programs, base utility bills or essential services. On the contrary, in contingency environments there is basically an open O&M checkbook to pay for the war, to include construction. This means that downrange commanders do not have to choose a new O&M construction project over keeping aircraft in the air – they can have both. The following sections will focus on constructing O&M projects in support of contingency operations, how engineers currently execute these projects and how better business practices could be adopted in the O&M construction arena.

### **Standards and an Environmental Focus**

Given the rules and regulations governing worldwide O&M construction, how much green construction fits into the bigger contingency picture? To begin answering this question, U.S. Central Command's (CENTCOM) specific guidance for construction in support of contingency operations should first be explained. "The Sand Book" provides guidance, responsibilities, and procedures for military construction and the planning and development of contingency and permanent base camps that support associated missions in CENTCOM AOR.<sup>36</sup> The Sand Book applies to all service component forces, CJTFs, and the DOD Contract

Construction Agencies (CCA) operating within the geographic area assigned to USCENTCOM. It offers guidance on everything from how many square feet of living space a deployed troop is authorized (for example 80 sqft for Enlisted grades 1-7) to how many people per shower (20 people earns one shower...not at the same time for you DADT pessimists). Appendix E of the book, titled Base Camp Environmental Considerations, states that:

Upon deployment to the CENTCOM AOR, all forces will actively prevent pollution, display environmental stewardship, respect the natural resources of the host nation, report and respond to hazardous chemical and POL spills, remedy environmental conditions that directly endanger the health and safety of U.S. and coalition forces, and comply with the spirit as well as the letter of applicable U.S. and host nation environmental regulations as modified by International Agreements and Status of Forces Agreement (SOFA), Final Governing Standards specific to the host nation or the DOD Overseas Environmental Baseline Guidance Document.

However, nowhere does the Sand Book offer specific facility guidance, merely indicating that services will comply with their own service procedures.<sup>37</sup> In short, this guide is the quick reference to building standards within the current contingency environment. But does it provide ample guidance?

The previously mentioned Camp Losano is not an isolated case. Trading away sustainable features for square footage should be considered the norm instead of the exception to the rule. Lt Col (s) Rick Dwyer, the Special Operations Central Command (SOCCENT) Engineer from March 2010 through November 2010, encountered a range of relevant issues during his recent deployment.<sup>38</sup> As the SOCCENT engineer, Lt Col Dwyer was responsible for O&M scope construction projects across the Middle East. He explained that for two reasons, sustainable features in the facilities he designed and built were not a consideration. First, the funding levels were too restrictive. "It is hard to build a green facility when you can barely afford to buy the building you need," he stated. "There is no way we can convince commanders, especially downrange, that they need to spend more of their limited project dollars on recycled

materials, or high efficiency lighting ballasts when we cannot even give them the building size they are authorized.”<sup>39</sup> The second point Dwyer raised was facility maintenance once U.S. forces have departed. “Why would we spend more money on green features when we are going to leave in a couple years anyway?” he asked. “Besides, the host nation does not have the training to maintain, fix, or even get parts for most of these higher technology systems anyway; so why waste the money?”<sup>40</sup>

As an example of these problems, he described a project he worked on in mid-2010. “Some of our SOF teams were working in an undisclosed location, trying to develop long-term relations with the local military,” he explained. “Well, they were living in conex boxes and that just wasn’t cutting it. So we built some trainer barracks, just simple CMU (concrete masonry units or cinder blocks) buildings that were light years better than what they were living in before but far from complicated. We didn’t install central HVAC or high efficiency lighting or sprinkler systems; basically we didn’t use anything we couldn’t get on the local economy.” He then asked, “Why would we install all those complicated things? We weren’t even sure if we were going to be there in two weeks much less two years - or ten. We built structures that if we left tomorrow, the locals would have no problems moving into immediately - simple, basic buildings that they can take and use without wondering how to use them.”<sup>41</sup>

Lt Col (s) Dwyer raises a series of important points. First is the importance of simplicity downrange. Bringing in highly efficient electronic components from the U.S. is time consuming and expensive. A focus on the local economy and building techniques is important when timeliness is paramount. Second, in expeditionary environments, every little bit counts. When comparing living in a metal box to having a concrete roof over your head, the decision is simple; and the quicker the living conditions can be enhanced the better. Third, when funding

constraints on O&M projects force commanders to choose between sustainable features or square footage, square footage wins out. After discussing his experiences, Lt Col Dwyer offered his personal feelings on the issue. "Building green is obviously the right thing to do in most situations. But sometimes it just doesn't fit all that well. Like the barracks I talked about or some of these small O&M projects downrange, the funding constraints are just too restrictive and the highly efficient materials aren't readily available. You spread the funding just far enough to cover the mission requirement and get what you can to stay under the limit." <sup>42</sup>

### **Why \$750,000 and Potential Future Changes to the Limit**

Tom Lowry, the program manager for all Air Force O&M construction stationed at Headquarters Air Force (the Pentagon) explained the history of the \$750,000 limit for O&M construction. The current \$750,000 O&M minor construction limit has been in effect since December of 2001. In recent years, the Air Force has made several unsuccessful attempts to increase that limit. "For the past six years we've tried to increase the level to no avail," Lowry stated. "The [Congressional] staffers just have not been supportive." However, Lowry spoke of ongoing initiatives to boost the funding level once again. In 2010, the Office of the Under Secretary of Defense for Acquisitions, Technology and Logistics OSD (AT&L) formulated the first unified Department of Defense stance on increasing O&M minor construction funding levels. "Up until 2010, the services were all submitting different numbers to the staffers," Lowry explained. "The Army went in with one number, the Navy with another, we had our own figure and still the medical community had a different idea. We were all over the board." <sup>43</sup>

With OSD (AT&L) leading the charge, the hope is that a unified DoD front will present Congressional staffers with watertight justification for changing the legislation. The bottom line up front on the congressional submission proposing the change is an increase in O&M minor

construction thresholds from \$750,000 to \$1M. The package explains that, “An increase to the (O&M minor construction) threshold does not generate cost implications, but rather recognizes the implications of construction market costs on DoD construction.”<sup>44</sup> Additionally, the submittal explains that this increase in authority would allow service secretaries greater flexibility in responding to urgent mission requirements as well as life-safety-health deficiencies by providing the ability for engineers to properly size and scope new facilities. Without question, the primary justification for the increase is that the current limits have not kept up with overall construction inflation. According to the Engineering News-Record Building Cost Index (BCI) as of July 2010, construction costs since December 2001 (when the current \$750,000 limit was set) have increased by 36%, demonstrating statistical support for a \$1M project limit. Though LEED or sustainable factors are not directly cited in the package, the term “properly scoped” can easily incorporate such initiatives.<sup>45</sup>

But is a \$1M threshold enough? Some say no. CENTCOM is pushing a package that is parallel to the one above.<sup>46</sup> Their proposal focuses on O&M minor construction only in support of a declaration of war, a Presidential declaration of a national emergency, or a contingency operation. In any one of these three situations, the service secretary concerned would be able to use funds available to carry out construction projects costing not more than \$3M.<sup>47</sup> When compared to AT&L’s submittal for an increase to \$1M, this is a dramatic increase.

Justification for this 400% increase hinges strictly on the timely nature of such initiatives and the rising cost of construction in current contingency environments. The proposal first states that “increasing the threshold provides an immediate authority at the Combined Joint Task Force (CJTF) level to execute projects that the commander needs without affecting longer-term project development.”<sup>48</sup> Simply put, O&M construction is the fastest way to build downrange. In

addition, the request explains that rising construction costs in the AOR are running rampant. Army Central Command (ARCENT) engineers have reported 20-40 percent construction cost growth.<sup>49</sup> These skyrocketing costs are proving far too restrictive and forcing many previously affordable construction projects over the limit. An easy parallel can be drawn to incorporating sustainable features into this category of contingency construction. If the services are canceling projects because they cannot afford them, how could anyone expect that more expensive green techniques and materials would be included?

### **Mission First**

Col Beth Brown, a 22-year career Air Force Civil Engineer and the current Director of Staff for the Air Force Civil Engineer, has extensive professional experience that sheds light on the issue of sustainability down range.<sup>50</sup> She began with the overall Air Force position on green construction: 100% of new vertical Military Construction (MILCON) projects and major renovation projects are supposed to be LEED Silver certifiable. She explained that an A7C (The Air Force Civil Engineer) policy letter currently in staffing would be issued later this year detailing this initiative. In short, the Air Force is committed to LEED techniques to the greatest extent possible, when they are not adapted at the cost of the mission. Col Brown, a veteran of several engineering based deployments, including that of Squadron Commander at Manas Air Base in Kurdistan in 2007, explained the importance of construction timelines mirroring those of mission requirements.<sup>51</sup>

According to Col Brown, construction in the AOR takes place in three primary phases. The first phase is the initial beddown. During Phase I actual construction is very limited. Expeditionary assets like tents, airfield matting and relocatable/reusable aircraft hangars are the focus (see Appendix B for examples). Facility assets for Phase I are primarily provided through

the use of War Reserve Materials (WRM) prepositioned around the globe postured for U.S. forces to utilize during initial contingency operations bed downs. Phase II focuses on moving out of expeditionary assets and into some type of improved, non-enduring facility. Primary construction practices include replacing airfield matting with concrete, erecting expedient structures such as pre-engineered buildings and K-spans and building plywood-type office and living facilities (see Appendix C for example). Stage III, as Col Brown describes it, transitions from an expeditionary installation to an enduring location. Phase III is represented by large-scale airfield improvements, including large-scale aircraft hangars and facilities constructed out of brick and mortar versus aluminum and fabric (see Appendix D for example). In short, Phase III happens only when there is a high likelihood that the installation is going to be operational for an extended period of time. When addressing LEED concerns in each of these phases, Col Brown pulls no punches in offering that there is little room for LEED considerations during Phase I and II. "The mission takes precedence and until we transition from expeditionary to enduring bases there isn't time to be overly concerned, beyond just simply doing what is right, with sustainable facility features."<sup>52</sup>

So when exactly is the transition from Phase II to Phase III? When can a base move from that of an expeditionary installation to one with enduring features and facilities? According to the Sand Book, "Permanent (enduring) basing is associated with long-term strategic force stationing; while contingency (expeditionary) basing is associated with short-term contingency operations. Specific location and size of these bases are determined during the course of the contingency operation."<sup>53</sup> In this light, one can infer that as a base shifts toward enduring or permanent status, so should construction techniques evolve from expedient and expeditionary to more permanent and sustainable. But who decides which installations evolve to "enduring"?

Again, according to the Sand Book, basing of forces at permanent installations is dictated by the Secretary of Defense in the Global Defense Posture (GDP). Bases included in the GDP are those locations where the U.S. is expected to have a long-term presence or need to rapidly expand sites at key locations within the AOR.<sup>54</sup> Following this, the responsibility for clearly defining enduring bases falls directly on the Secretary of Defense.

But there are significant political implications to labeling a base in a foreign country “enduring,” as Col Brown points out. “Politically, anyone would be hesitant to say that we are going to have an enduring presence in Iraq. It just is not going to happen,” she says.<sup>55</sup> Terms like “enduring” or “permanent” conjure thoughts of an occupying force or military domination, an image that politicians are not willing to portray to the world. So for stateside installations or partner country endeavors, making the GDP list is not an issue, but contingency locations just are not going to make the list; therefore they get stuck in the grey area between Phase II and III construction and never make to the transition to the construction of higher quality, non-expeditionary type facilities. For this reason, one could conclude that a third classification of installation may be in order. A category such as “robust expeditionary” could fit in that grey area and act as a go-between to assist contingency installations into Phase III of construction without having to call these installations “enduring.” This possibility will be discussed in the final section of the paper, where I make recommendations for the implementation of sustainable practices in down range construction.

### **SAF/IE Speaks Out**

Even as the complexity of moving from Phase II to Phase III becomes clear, some argue that it should not matter and small steps need to be taken regardless of whether installations are expeditionary or enduring. A report titled “Improving Energy Efficiency in a Deployed

Environment” was recently released by the Deputy Undersecretary of the Air Force for Installations and Environment.<sup>56</sup> One of the major findings of the report is that a reduction in the consumption of fossil fuels is directly proportionate to a reduced risk of loss of human life. Fuel in the AOR is transported along road systems – the same roads used by the enemy. These convoys are then subject to hijackings and attacks at an alarming rate. In 2009, one contractor reported that over 140 of their personnel were killed in logistics convoys in support of U.S. and NATO locations.<sup>57</sup> Simply put, increasing energy efficiency saves lives in the AOR.

A second major recommendation of the report advocates investment in infrastructure where there is a projected return equal or greater to the initial expenditure. The example provided in the report does an outstanding job of laying out this option:

When deciding between \$10 per square-foot and \$15 per square-foot, the decision is easy. The extra \$5 per square-foot for efficient construction is sacrificed in exchange for more space. If the cost to operate and maintain the infrastructure (specifically, HVAC, lighting and hot water) is considered, the \$5 per square-foot spent on efficient building at a fully burdened cost of fuel for power generation rapidly pays for itself.<sup>58</sup>

The report points out that the driver for this “on the cheap” attitude toward construction is the restrictions found in Title 10. “The \$750,000 minor construction threshold causes us to maximize square-footage and eliminate extraneous features within projects—especially those contributing to efficiency.”<sup>59</sup> The report adds, “Because of these political hurdles, commanders choose to spend O&M dollars to get the greatest square footage, willingly or unwittingly accepting much higher O&M costs for the life of the facilities.”<sup>60</sup> The report continues, explaining the difficulties in transitioning between Phase II and III construction techniques; because most bases in the AOR are not considered “enduring,” more permanent construction techniques are not used. Finally, the report recommends an exception to policy with regards to

the \$750,000 minor construction limit for downrange installations, citing energy efficiency as a driving factor.

The final lesson from this report is the importance of providing guiding governance at installation and Major Command level. Simply stated, there need to be published instructions for commanders to follow and adherence to these instructions needs to be verified. First, at the strategic level, the recently established Air Force Energy Office, through their facilitation of the various working groups under the Energy Senior Focus Group (SFG), needs to provide overarching governance to the Air Force's energy efforts.<sup>61</sup> Second, at the Major Command level, is the formation of an Energy Management Steering Group whose task is to ensure sustainable efficiencies are a focus on all the installations across the AOR.<sup>62</sup> Third, at the installation level, a dedicated Energy Manager Position must be established who is focused on all energy efficiency efforts to include installations, aviation and vehicles.<sup>63</sup> Even with these recommendations, the report recognizes constraints placed on units in the AOR and that mission accomplishment must remain the top priority.

### **Is LEED even a Good Idea in the Contingency Environment?**

Going green downrange may sound like an excellent idea, but how much good will it really do? The same SAF/IE study mentioned previously throws out a staggering statistic that seeks to derail any sustainable construction initiative: "Aviation fuel use accounts for over 96% of overall energy use in the CENTCOM AOR"<sup>64</sup> - 96.6%, to be exact.<sup>65</sup> This number, according to the report, is based on three significant combat challenges faced by aircrews moving around the AOR. First, effectiveness is more important than efficiency during combat operations; the job must get done no matter the drain on resources.<sup>66</sup> Second, combat environments are complex and operating within them drives significant inefficiencies.<sup>67</sup> Third,

it is difficult to connect efficiency as a focus to effectiveness of the mission.<sup>68</sup> Simple math points out that if only 3.4% of all downrange energy consumed by the Air Force is through the operation of non-aviation assets, how can efficiencies in facilities even make a dent? Nonetheless, it is clear that every little bit helps – especially when considering the logistics of fuel consumption.

The U.S. Marines have recently taken this fuel reduction to heart. In an August 2009 speech at the Marine Corps Energy Summit the Commandant of the Marine Corps voiced his support for green initiatives and the importance of reducing fuel consumption in contingency environments.<sup>69</sup> Fuel constitutes approximately fifty percent of all logistical tonnage movement in today's fight.<sup>70</sup> A recent study from 2007 found that the U.S. military loses one person, killed or wounded, for every 24 fuel convoys it runs in Afghanistan.<sup>71</sup> Comparing these two statistics easily yields the conclusion that using less fuel requires fewer convoys, leading to fewer U.S. military members being lost or wounded on the battlefield – plain and simple.

Another argument against these recommendations stems from Congressional considerations. It is unlikely that any elected official or professional staffer would publicly oppose green construction. They would, however, fight tooth and nail against any increase in the minor construction limit. Previous increase requests from the services and CCOMS have been repeatedly denied, with the stated rationale simply that, “sufficient (contingency) construction authority is found in existing law.”<sup>72</sup> So why does Congress care how much the services spend on construction projects, especially those in support of contingency operations? The answer is two-fold: first, simple economics shows that every dollar diverted downrange is one that does not support the constituents in their district – the same constituents that vote them into (or out of) office; second, with the open checkbook I explained previously, Congress has less control over

the spending if the limit increases. One might think that the small amount of increase from \$750,000 to \$1M might not matter that much in the big picture. However, when one considers the fact that literally thousands of O&M projects are executed downrange every year, much like the potential energy savings, every little bit of savings counts.

A final argument against building green in the downrange environment is the availability of green building materials and maintenance of sustainable features once they are installed. Major Todd Graham, RED HORSE Detachment 1 Commander, Camp Leatherneck Afghanistan from Jan-July 2010, discussed his experiences with this issue. "We were doing everything we could to get higher quality materials into our construction projects, equipment that would last and be more energy efficient."<sup>73</sup> Major Graham described one such initiative focused on hot water heaters. "The water heaters coming out of Dubai and other Middle East countries were not industrial grade and could not keep up with the constant load placed upon them by the troops."<sup>74</sup> To combat this problem, Major Graham used U.S. heaters instead. "Though we paid a premium for these hot water heaters (mostly to fly them in directly from the States), in the long run I am hopeful that the life cycle cost will be less than anything we could have procured locally."<sup>75</sup> This example provides a clear argument that although higher quality U.S. equipment may not be available in contingency environments, the life cycle cost of procuring higher quality, more energy efficient systems is in some cases well worth the investment.

### **Key Lessons Learned and Recommendations**

Of the nearly 50 Air Force Civil engineer officers with whom I have discussed this topic over the past several months, not one of them stated that incorporating LEED principles into construction projects regardless of location was a bad idea. Consequently, the question becomes how and when to implement green practices. I recommend a three-pronged approach. First, to

afford LEED characteristics in minor construction projects, the \$750,000 O&M limit needs to be increased. Second, incorporating LEED principles into facilities in contingency environments cannot slow the pace of construction to the point of hindering the mission. For this reason, I propose that LEED only be a *major* consideration once an installation has officially been labeled either “robust expeditionary” or “enduring” by the proper authorities (I will explain “robust expeditionary” below). This does not mean that green techniques and efficiencies are completely ignored during earlier phases of construction and development of installations; it simply means that sustainability is secondary to mission until there is ample time to mandate sustainable features (for additional information on building a contingency base, see Appendix E: “Building in a Contingency Vacuum”). Finally, for LEED to be consistently at the forethought of our construction practices, clear guidance needs to be incorporated into Air Force Instruction 32-1032, *Planning and Programming Appropriated Funded Maintenance, Repair, and Construction Projects*.

The proposal by CENTCOM that is currently on the table would increase the minor construction limit to \$3M in the AOR. A \$3M threshold would more than cover incorporating green techniques into down range projects. But some are skeptical. Tom Lowry speculated, “I don’t think the \$3M request is going to be approved...it’s just too much of a jump all at once; but \$1M, now that’s a distinct possibility (referring to the OSD/AT&L sponsored proposal).” The main reason he feels the increase will be accepted after years of trying is OSD’s involvement. “For the first time in this initiative, all the Services are on the same page,” he said. When asked if \$1M was enough, he smiled and simply said, “It would be a step in the right direction.”<sup>76</sup> This opinion was shared as Lt Col (s) Dwyer had much the same thoughts; “Going

to \$1M is better than staying where it is, but I doubt it will fix the green problem; it is just going to allow us to buy more square footage.”<sup>77</sup>

Incorporating LEED principles into minor construction projects in the AOR is the right thing to do as long as it does not slow the project to the point that it becomes late-to-need in meeting mission requirements. Contingency operations are 100% focused on the mission and installations are a key enabler to mission success for the Air Force. Installations are key power projection platforms and in early stages of conflict they always lag behind mission requirements. As Col Brown pointed out, until an installation is going to be officially labeled “enduring,” LEED needs to take a back seat.<sup>78</sup> The current challenge for engineers is knowing exactly when installations shift from expeditionary to enduring. Logically, this trail leads to the Office of the Secretary of Defense. However, for political reasons OSD cannot be expected to label specific bases in the AOR either expeditionary or enduring. For this reason, CENTCOM needs to publish annually (at a minimum) a list of “robust expeditionary” installations that will remain active into the foreseeable future. The development of this new class of installation would not strain political ties through its avoidance of the hated “enduring” term, yet it would allow engineers to better focus their construction initiatives. Then, by default, those installations not on the “robust expeditionary” or “enduring” list should not leave Phase II of construction as explained by Col Brown and not embrace permanent construction projects. This does not mean that all environmental concerns should be dismissed during Phases I and II. Simple green investments can still take place. For example, motion detectors on light switches or efficient lighting can be used. However, large initiatives like central HVAC systems or shipping in hot water heaters from the U.S. should be avoided. The reason to keep investment levels relatively low is twofold: first, sustainable features have the potential to take longer thus slowing the rate

of construction; second, as Lt Col Dwyer explained in his example above, if we will be only using the facilities for a short duration of time, green is not worth the investment and it complicates potential turn-over.<sup>79</sup>

Finally, for LEED to become a focus, it needs to be included in all relevant governing rules and regulations. Contrary to the A7C policy letter currently in staffing, I would not propose a mandate of LEED Silver Certifiable for all minor construction projects. Rather, I suggest that AFI 32-1032 include direction that required programming documents include a statement about LEED and that green techniques be incorporated to the maximum extent possible. Commanders in the field must maintain autonomy to make decisions between square footage and efficiency. However, it is the engineers' responsibility in the field to nudge these commanders toward green initiatives by explaining the benefits and providing applicable governing instructions and regulations. This aids in the engineers' argument for efficient facilities instead of big facilities.

### **Conclusion**

When General Walsh cut Camp Losano's ribbon on the 4th of July 2010 he opened a premier Air Force cantonment area. In a little less than 11 months, engineers from the 451st Expeditionary Civil Engineer Squadron had turned a dirt field into a bustling hub of activity for the Air Force's newest wing. But it could have been so much better had funding restrictions not been so tight and CENTCOM and Air Force guidance been clearer as to allowable construction techniques as well as the importance of green construction techniques. On a brighter note, less than a month after completing the project, engineers were sprinting down the green path. An effort to tie into the base power supply was well underway and approval had been granted to tie the Camp into the main underground sewage system. These two initiatives alone would save

thousands of gallons of fuel weekly (generators running at the camp burned an estimated 80 gallons of diesel per hour). At the same time, had Kandahar been a “robust expeditionary” installation with the ability to spend \$1M on O&M projects led by clear guidance in AFI 32-1032, the need to go back and fix the problem never would have existed.

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<sup>1</sup> Thornton, Renni, 451st AEW marks first year in Afghanistan, 5 July 2010

<sup>2</sup> Raymond Losano, Airman First Class, United States Air Force, Arlington National Cemetery Website, 16 May 2003

<sup>3</sup> Ibid.

<sup>4</sup> Personal observation, author, May 2011.

<sup>5</sup> Mayor Menino’s Green Building Task Force Report. Executive Summary: Fall 2004. pp. 4

<sup>6</sup> Ibid. p. 4

<sup>7</sup> United States Green Building Council, WHAT LEED IS.

<sup>8</sup> Ibid.

<sup>9</sup> Ibid.

<sup>10</sup> Buildings and their Impact on the Environment: A Statistical Summary. United States Environmental Protection Agency, 22 April 2009. P. 1.

<sup>11</sup> Ibid, p. 1.

<sup>12</sup> Green Affordable Housing Facts, Frontier Associates.

<sup>13</sup> Green Affordable Housing Coalition Fact Sheet: Top 15 Green Building Ideas, Frontier Associates. P.1.

<sup>14</sup> Ibid, p. 1.

<sup>15</sup> Yeaton, Bryan, “Middle East Climate,” The Weather Notebook, 14 May 2003, p. 1.

<sup>16</sup> Ibid, p. 1.

<sup>17</sup> Ibid, p. 1

<sup>18</sup> United States Air Force: Improving Energy Efficiency in a Deployed Environment. On-Site Assessment Sponsored by SAF/IE Sponsored Team. p. 4.

<sup>19</sup> Green Affordable Housing Coalition Fact Sheet: Top 15 Green Building Ideas, p. 2.

<sup>20</sup> Personal observation, author, May 2011.

<sup>21</sup> Ibid, p. 2.

<sup>22</sup> Ibid, p. 2.

<sup>23</sup> U.S. Code, Title 10, Subtitle A, Part IV, Chapter 169, Subchapter I, Section 2801.

<sup>24</sup> Ibid.

<sup>25</sup> Rugs, Veronique de, “The Trillion Dollar War,” Reason.com, May 2008, p. 3.

<sup>26</sup> Hutchison, Michael, *USAF Program Brief: Military Construction and Beyond*, July 2010, slide 51-53.

<sup>27</sup> U.S. Code, Title 10, Subtitle A, Part IV, Chapter 169, Subchapter I, Section 2804.

<sup>28</sup> Lowry, Thomas, e-mail to author, 21 January 2011. Over the years, contingency construction authority has been placed under several sections of Title 10 to include Section 2808 in 2004, 2810 in 2005, 2809 in 2006 2802 in 2007, 2801 in 2008, 2806 in 2009 and 2010 and most recently in 2805 for the current 2011 cycle.

<sup>29</sup> Phillips, W. Darrell. “Use of operation and maintenance funds during deployments: an informative overview of the proper use of O&M funds,” Fall 2006. Entrepreneur.

<sup>30</sup> AIR FORCE INSTRUCTION 32-1021, Civil Engineering, PLANNING AND PROGRAMMING MILITARY CONSTRUCTION (MILCON) PROJECTS, 14 Jun 2010 p. 1.

<sup>31</sup> Ibid, p. 2.

<sup>32</sup> AIR FORCE INSTRUCTION 32-1023, Civil Engineering DESIGNING AND CONSTRUCTING MILITARY CONSTRUCTION PROJECTS, APRIL 2010, p. 2.

<sup>33</sup> AIR FORCE MANUAL 32-1089, AIR FORCE MILITARY CONSTRUCTION AND FAMILY HOUSING ECONOMIC ANALYSIS GUIDE, Aug 1996, p. 2.

<sup>34</sup> U.S. Code, Title 10, Subtitle A, Part IV, Chapter 169, Subchapter I, Section 2805

<sup>35</sup> Lowry, Thomas, Interview with author, 14 January 2011.

<sup>36</sup> The Sand Book, HEADQUARTERS UNITED STATES CENTRAL COMMAND, 17 Dec 2007, p. 1-1.

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- <sup>37</sup> Ibid. 9-2.
- <sup>38</sup> Dwyer, Lt Col (s) Richard, Interview with author, 14 January 2011.
- <sup>39</sup> Ibid.
- <sup>40</sup> Ibid.
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- <sup>42</sup> Dwyer, Lt Col (s) Richard, Interview with author, 14 January 2011.
- <sup>43</sup> Lowry, Thomas, Interview with author, 14 January 2011.
- <sup>44</sup> Title 10 Proposal from OSD, "Increase in Dollar Thresholds for Authorities Relating to Unspecified minor Construction Projects," p. 2.
- <sup>45</sup> Ibid, p. 2.
- <sup>46</sup> Title 10 Proposal from CENTCOM, "Enhanced Authority for use of Operations and Maintenance Funds for Unspecified Minor Military Construction in Support of Contingency Operations"
- <sup>47</sup> Ibid, p. 1.
- <sup>48</sup> Ibid, p. 2.
- <sup>49</sup> Ibid, p. 2.
- <sup>50</sup> Brown, Colonel Elizabeth A., Interview with author, 14 January 2011.
- <sup>51</sup> Ibid.
- <sup>52</sup> Ibid.
- <sup>53</sup> The Sand Book, Pp. 3-1.
- <sup>54</sup> The Sand Book, Pp. 3-1.
- <sup>55</sup> Brown, Colonel Elizabeth A., Interview with author, 14 January 2011.
- <sup>56</sup> United States Air Force: Improving Energy Efficiency in a Deployed Environment.
- <sup>57</sup> Ibid. p. 3.
- <sup>58</sup> Ibid, p. 3
- <sup>59</sup> Ibid. p. 4.
- <sup>60</sup> Ibid, p. 4.
- <sup>61</sup> Ibid, p. 32.
- <sup>62</sup> Ibid, p. 5.
- <sup>63</sup> Ibid, p. 27.
- <sup>64</sup> Ibid, p. 9.
- <sup>65</sup> Ibid, p. 9.
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- <sup>67</sup> Ibid, p. 9.
- <sup>68</sup> Ibid, p. 9.
- <sup>69</sup> Cobb, Adam, "IEDS, Casualties, Fuel and War: A Report on the USMC Energy Summit" in *The Marine Corps Gazette*
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- <sup>71</sup> Friedman, Thomas L. "The USS Prius" *The New York Times*. The Opinion Pages. p. 4.
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- <sup>74</sup> Graham, Todd, e-mail message to author, 16 February 2011.
- <sup>75</sup> Ibid.
- <sup>76</sup> Lowry, Thomas, Interview with author, 14 January 2011.
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\* This paper was reviewed and edited by Dr. Rachel DeMotts, Associate Professor, University of  
Puget Sound, WA on 2 Dec 2010, 15 Jan 2011 and 17/21 Feb 2011.

## Appendix A – Camp Losano Grand Opening 4 July 2010



Ms. Zeynep Betty Tali, deputy general manager, KBY International Construction Co., Brig. Gen. Guy Walsh, 451st Air Expeditionary Wing commander, Col. Todd Tyree, 451st Expeditionary Mission Support Group commander, and Chief Master Sgt. Steve McDonald, 451st AEW command chief, participate in a ribbon-cutting ceremony July 2 to open brand-new work and living facilities, marking the one-year anniversary of the wing's activation at Kandahar Airfield, Afghanistan. (U.S. Air Force photo by Senior Airman Nancy Hooks/Released)\*

\* Picture and caption retrieved from: <http://www.kdab.afcent.af.mil/news/story.asp?id=123212186>

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## Appendix B – Example of Phase I Bare Base Assets

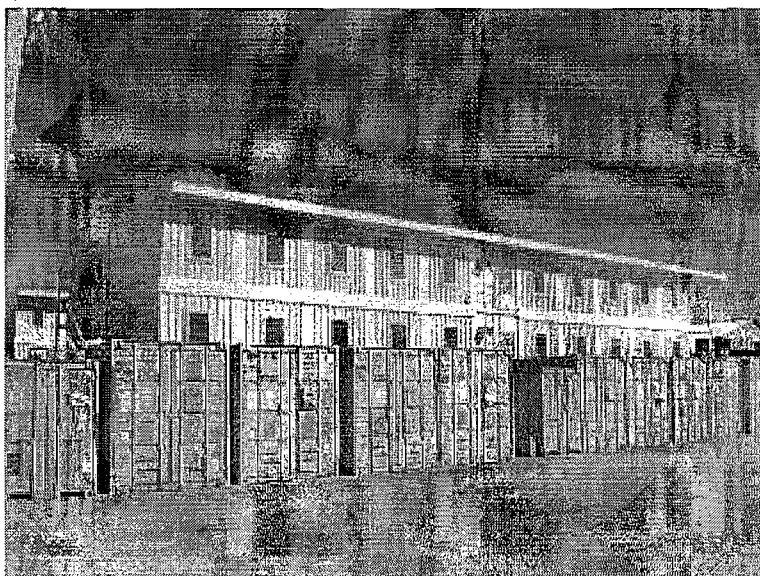


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## Appendix C – Example of Phase II Expedient Construction

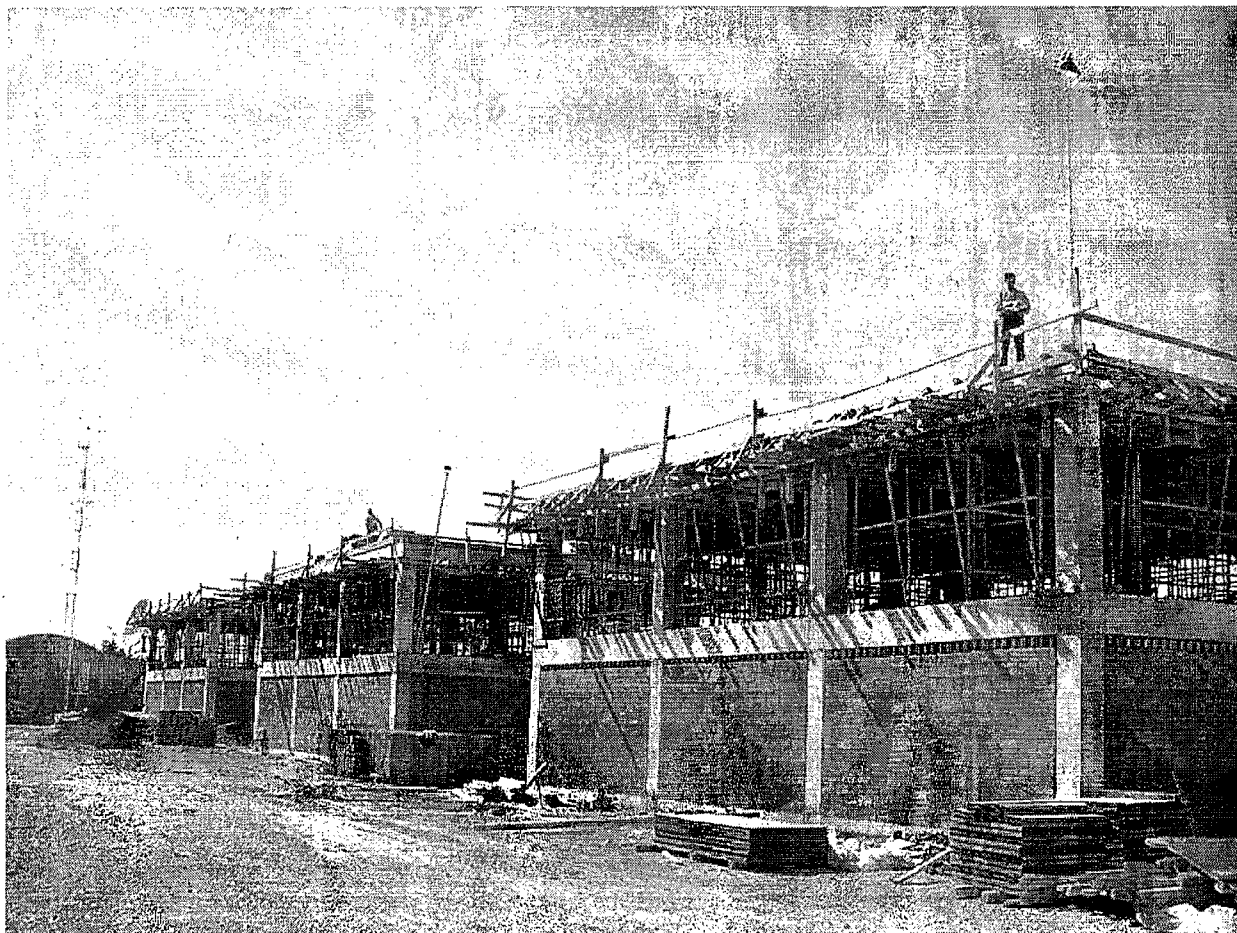


B-Huts Being Built (above), Relocatable/Modular Building (below)



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## Appendix D – Example of Phase III Permanent Construction



Poured structural concrete frame with CMU inset walls. Camp Losano early 2010.

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## **Appendix E: Building in a Contingency Vacuum (thoughts from the Author)**

The dream of every Air Force Civil Engineer is to deploy into a new contingency location and build a base from the ground up. The components of this ground-up construction process include infrastructure (power, water, wastewater, communications and roads), facilities (billeting, admin, industrial and morale) and airfield operations (runway, taxiways, parking aprons, control tower, hangars and support facilities). To construct the optimal base, there are three crucial considerations. First, we must know 100% of the requirements over the life of the installation. This means how many people, aircraft, vehicles, communications nodes, electrical equipment, and so on that will operate on the installation to accomplish the mission. The second requirement is a bare piece of ground amply sized to house all of these requirements. The third necessity is all of the required material, personnel to set that material up, and enough time to accomplish the work prior to the mission taking place. Given these three things, the following will offer a brief picture of an ideal base.

Arguably, the most important feature of an air base is the runway and supporting airfield aprons and facilities. The first thing to site on our ideal base is the runway, parallel to the prevailing winds and supported by attached taxiways, parking aprons, hangars and support facilities adequately sized for assigned and transient aircraft. With the airfield sighted, infrastructure lays the foundation for the remainder of the base. This foundation consists of a central grid pattern outlined in the basic shape of city blocks. This grid pattern will comprise the road system along which the buried utilities will skirt. These utilities, including water, wastewater, communications and electricity, are all centrally provided. Water is supplied by a series of redundant wells where it is treated and distributed. Wastewater flows to a geographically separated (downwind) sedimentation pond. Communications flow to a

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centralized, well-protected hub that controls the lifeline of the base. Electricity is distributed by a smart grid from a series of two or three diesel generator plants adequately sized to allow periodic maintenance of individual units. Across the base, small generators act as back-up units should the main system become inoperable. This main system is the life line of a green installation. The ability to provide centralized utilities is by far the top efficiency technique an expeditionary engineer can apply. With the green infrastructure set, facilities are grouped by function. Living and morale structures are lumped together, flight line operations are on the airfield, and leadership is close enough to each other to enable quick face-to-face decision-making, thus enhancing communication.

Ideally, engineers creating this utopia would know the duration of the mission set and be able to build accordingly. For short term durations, 3-5 years, expeditionary assets would prove ample. Tents, trailer units and relocatable fabric-skinned aircraft shelters would act as the facilities of choice. For longer term durations, more permanent facilities would be the focus. Concrete and pre-engineered buildings would dominate the skyline and be full of small green initiatives such as passive solar, high efficient lighting, motion detector light switches, low-flow water fixtures and centralized HVAC systems; all of which would decrease the draw requirement on the centralized infrastructure. Finally, all efforts on an air base are centered on flight line operations. Much like the old saying that all roads lead to Rome, on an air base, all roads lead to the airfield. But rarely are these ideal conditions described in the previous two paragraphs present when engineers attempt to construct installations in contingency environments.

Several challenges face engineers attempting to tackle mission bed downs. The first is a lack of clearly defined mission requirements. Fluidity in today's contingency environments is the standard, not the exception to the rule. Ever-changing mission requirements plague

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engineers attempting to construct facilities and infrastructure to support them. To state the matter simply, you cannot construct facilities to support assets that you do not know you are going to have. Second, rarely are the engineers ever truly the first to the scene. By the time we arrive, squatters have started operating everywhere. Rarely do engineers get the bare piece of ground adequately sized to support the ill-defined mission. To “make it happen,” engineers grab chunks of land here and there and do their best to site functions and facilities on these patches of earth to accomplish their specific mission. For example, as the base engineer on a recent deployment to Kandahar, Afghanistan, I had 16 separate sites that housed Wing functions that needed support, and some of these were as much as five miles apart from each other. This led to water and wastewater trucking, electrical power spot generation and emergency response times up to thirty minutes. This setup illustrates Webster’s definition of inefficiency.

The final challenge engineers face is the availability of assets. Construction and materials standards in other parts of the world are far lower than what we are used to in the U.S. High efficiency hot water heaters, lighting ballasts and water pumps are nonexistent unless shipped from the U.S. Building codes are far less stringent and the quality of construction shows it. For example, in the U.S. we install wiring in accordance with the national electric code (NEC). In Afghanistan, they install wiring in accordance with switch-flip standards. That is, if the switch is flipped and the lights go on, it must be right.

Despite the many challenges engineers face downrange, their focus on the mission and ability to support it – no matter how ill-defined – is outstanding. Every day Air Force engineers are performing acts of selflessness in support of contingency operations. Be it power production specialists spending eighteen hours a day, seven days a week, to keep an aging fleet of diesel generators running or utilities journeymen ensuring everyone gets a hot shower, engineers make

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it happen. However, with a little more foresight by senior leaders on future mission sets, a few more resources and a little more time, we could be dramatically more efficient, providing the mission and our troops with what they need as well as the quality they deserve.